SBIR

Small Business Innovation Research

FY 2004

NOAA PROGRAM SOLICITATION

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U.S. DEPARTMENT OF COMMERCE
http://www.oar.noaa.gov/ORTA/SBIR

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U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

PROGRAM SOLICITATION FOR SMALL BUSINESS INNOVATION RESEARCH

1.0 PROGRAM DESCRIPTION

1.1 Introduction

The Department of Commerce (DOC) National Oceanic and Atmospheric Administration (NOAA) invites small businesses to submit research proposals under this solicitation. Firms with strong research capabilities in any of the areas listed in Section 8 of this solicitation are encouraged to participate. **Unsolicited proposals are not accepted under the Small Business Innovation Research (SBIR) program**.

Objectives of this program include stimulating technological innovation in the private sector and strengthening the role of small business in meeting Federal research and development (R&D) needs. This program also seeks to increase the commercial application of innovations derived from Federal research and to foster and encourage participation by socially and economically disadvantaged and woman-owned small businesses.

1.2 Three-Phase Program

The "Small Business Innovation Research Program Reauthorization Act of 2000" requires the Department of Commerce to establish a three-phase SBIR program by reserving a percentage of its extramural R&D budget to be awarded to small business concerns for innovation research.

The funding vehicles for NOAA's SBIR program in both Phase I and Phase II are contracts. This document solicits Phase I proposals only.

NOAA has the unilateral right to select SBIR research topics and awardees in both Phase I and Phase II, and to award several or no contracts under a given subtopic.

1.2.1 Phase I - Feasibility Research

The purpose of Phase I is to determine the technical feasibility of the proposed research and the quality of performance of the small business concern receiving an award. Therefore, the proposal should concentrate on research that will significantly contribute to proving the feasibility of the proposed research, a prerequisite to further support in Phase II.

1.2.2 Phase II - Research and Development

Only firms that are awarded Phase I contracts under this solicitation will be given the opportunity of submitting a Phase II proposal immediately following completion of Phase I. Phase II is the R&D or prototype development phase. It will require a comprehensive proposal outlining the research in detail and a plan to commercialize the final product. NOAA may require delivery of the prototype. Each Phase II applicant will be required to provide information for the SBA Tech-Net Database System (http://tech-net.sba.gov), when advised this system can accept their input.

Further information regarding Phase II proposal and Tech-Net requirements will be provided to all firms receiving Phase I contracts.

1.2.3 Phase III - Commercialization

In Phase III, it is intended that non-SBIR capital be used by the small business to pursue commercial applications of Phase II.

1.3 Eligibility

Each organization submitting a proposal **must** qualify as a small business (Section 2.1) for research or R&D purposes (Section 2.2) at the time of the award. In addition, the primary employment of the principal investigator must be with the small business at the time of the award and during the conduct of the research. More than one-half of the principal investigator's time must be spent with the small business for the period covered by the award. **Primary employment with a small business precludes full-time employment with another organization. Deviation from these requirements must be approved by the program manager in consultation with the contracting officer.**

Also, for both Phase I and Phase II, the work must be performed in the United States. "United States" means the fifty states, the territories and possessions of the United States, the Commonwealth of Puerto Rico, the District of Columbia, the Republic of the Marshall Islands, the Federated States of Micronesia, and the Republic of Palau. **The program manager in consultation with the contracting officer may approve exceptions to this requirement.**

Joint ventures and limited partnerships are eligible, provided the entity created qualifies as a small business as defined in this solicitation. **Consultative arrangements between firms and universities or other non-profit organizations are encouraged, with the small business serving as the prime contractor.**

1.4 Contact with NOAA

In the interest of competitive fairness, oral or written communication with NOAA or any of its components concerning additional information on the technical topics described in Section 8 of this solicitation **is prohibited**.

Requests for general information on the NOAA SBIR program may be addressed to:

Dr. Joseph M. Bishop, NOAA SBIR Program Manager
1335 East-West Highway, Silver Spring, MD 20910-3284
Telephone: (301) 713-3565, Fax: (301) 713-4100
E-mail: joseph.bishop@noaa.gov

Information sources are listed in Section 7.

2.0 DEFINITIONS

2.1 Small Business Concern

A small business concern is one that, at the time of award for Phase I and Phase II:

(a) is independently owned and operated, is organized for profit, is not dominant in the field of operation in which it is proposing, and has its principal place of business located in the United States (Section 1.3);

(b) is at least 51 percent owned, or in the case of a publicly owned business, at least 51 percent of its voting stock is owned by United States citizens or lawfully admitted permanent resident aliens; and

(c) has, including its affiliates, a number of employees not exceeding 500, and meets the other small business regulatory requirements found in 13 Code of Federal Regulations Part 121. Business concerns are affiliates of one another when, either directly or indirectly, (1) one concern controls or has the power to control the other, or (2) a third party controls both. Control can be exercised through common ownership, common management, and contractual relationships. Business concerns include, but are not limited to, any individual, partnership, joint venture, association, or cooperative.

2.2 Research or Research and Development

Any activity that is (a) a systematic, intensive study directed toward greater knowledge or understanding of the subject studied; (b) a systematic study directed specifically toward applying new knowledge to meet a recognized need; or (c) a systematic application of knowledge toward the production of useful materials, devices, systems, or methods, and includes design, development, and improvement of prototypes and new processes to meet specific requirements.

In general, the NOAA SBIR program will fund Phase I and II proposals with objectives that can be defined by (b) and (c) above.

2.3 Socially and Economically Disadvantaged Small Business Concern

Is one that is:

(a) at least 51 percent owned by (1) an American Indian tribe or a native Hawaiian organization, or (2) one or more socially and economically disadvantaged individuals, and

(b) controlled by one or more such individuals in its management and daily business operations.

A socially and economically disadvantaged individual is defined as a member of any of the following groups: Black Americans, Hispanic Americans, Native Americans, Asian-Pacific Americans, Subcontinent Asian Americans, or any other individual found to be socially and economically disadvantaged by the Small Business Administration (SBA) pursuant to Section 8(a) of the Small Business Act, 15 U.S. Code (U.S.C.) 637(a).

2.4 Women-Owned Small Business

A small business that is at least 51 percent owned by a woman or women who also control (meaning to exercise the power to make policy decisions) and operate (meaning being actively involved in the day-to-day management) the small business.

2.5 Funding Agreement

The funding vehicles for NOAA's SBIR program in Phase I and Phase II are contracts.

2.6 Subcontract

This is any agreement, other than one involving an employer-employee relationship, entered into by a Federal Government funding awardee, calling for supplies or services required solely for the performance of the original funding agreement.

2.7 Commercialization

This is locating or developing markets and producing and delivering products or services for sale (whether by the originating party or by others). As used here, commercialization includes both Government and private sector markets.

3.0 PROPOSAL PREPARATION INSTRUCTIONS AND REQUIREMENTS

3.1 Proposal Requirements

The objective is to provide sufficient information to demonstrate that the proposed work represents a sound approach to the investigation of an important scientific or engineering innovation worthy of support. **The proposal must meet all the requirements of the subtopic in Section 8 to which it applies**. A proposal must be self-contained and written with all the care and thoroughness of a scientific paper submitted for publication. It should indicate a thorough knowledge of the current status of research in the subtopic area addressed by the proposal. **A proposal will not be deemed acceptable if it represents presently available technology.** Each proposal should be checked carefully by the offeror to ensure inclusion of all essential material needed for a complete evaluation. The proposal will be peer reviewed as a scientific paper. (All units of measurement should be in the metric system).

NOAA reserves the right not to submit to technical review any proposal which has insufficient scientific and technical information, or one which fails to comply with the administrative procedures as outlined in the NOAA/SBIR Checklist in Section 10.

The proposal must not only be responsive to the specific NOAA program interests described in Section 8 of the solicitation, but also serve as the basis for technological innovation leading to **new commercial products, processes, or services.** An organization may submit different proposals on different subtopics or different proposals on the same subtopic under this solicitation. When the proposed innovation applies to more than one subtopic, the offeror must choose that subtopic which is most relevant to the offeror's technical concept.

Proposals principally for the commercialization of proven concepts or for market research must not be submitted for Phase I funding, since such efforts are considered the responsibility of the private sector.

The proposal should be direct, concise, and informative. Promotional and other material not related to the project shall be omitted. **The Phase I proposal must provide a description of potential commercial applications.**

3.2 Phase I Proposal Limitations

- Page Length - **no more than 25 pages**, consecutively numbered, including the cover page, project summary, main text, references, resumes, any other enclosures or attachments, and the proposal summary budget.
- Paper Size - must be 21.6 cm X 27.9 cm (8 ½" X 11").
- Print Size - **must be easy to read with a fixed pitch font of 12 or fewer characters per inch or proportionally spaced font of point size 10 or larger with no more than 6 lines per inch. Margins should be at least 2.5cm.**

Supplementary material, revisions, substitutions, audio or video tapes, or computer floppy disks will **not** be accepted.

Proposals not meeting these requirements will be returned without review.

3.3 Phase I Proposal Format

3.3.1 Cover Sheet

Complete Section 9.1 "Cover Page" as page 1 of each copy of each proposal. **NO OTHER COVER WILL BE ACCEPTED.** Xerox copies are permitted.

3.3.2 Project Summary

Complete Section 9.2 "Project Summary" as page 2 of your proposal. The technical abstract should include a brief description of the problem or opportunity, the innovation, project objectives, and technical approach.

In summarizing anticipated results, include technical implications of the approach (for both Phase I and II) and the potential commercial applications of the research. **The Project Summary of proposals that receive an award will be published by NOAA and, therefore, must not contain proprietary information.**

3.3.3 Technical Content

Beginning on page 3 of the proposal, include the following items with headings as shown:

(a) **Identification and Significance of the Problem or Opportunity.** Make a clear statement of the specific research problem or opportunity addressed, its innovativeness, commercial potential, and why it is important. Show how it applies to a specific subtopic in Section 8.

(b) **Phase I Technical Objectives.** State the specific objectives of the Phase I effort, including the technical questions it will try to answer to determine the feasibility of the proposed approach.

(c) **Phase I Work Plan.** Include a detailed description of the Phase I R&D plan. The plan should indicate not only what will be done, but where it will be done, and how the R&D will be carried out. The methods planned to achieve each objective or task should be discussed in detail. **This section should be at least one-third of the proposal.**

(d) **Related Research or R&D.** Describe research or R&D that is directly related to the proposal, including any conducted by the principal investigator or by the proposer's firm. Describe how it relates to the proposed effort, and describe any planned coordination with outside sources. **The purpose of this section is to persuade reviewers of the proposer’s awareness of recent development in the specific topic area and assure them that the proposed research represents technology presently not available in the marketplace.**

(e) **Key Personnel and Bibliography of Related Work.** Identify key personnel involved in Phase I, including their related education, experience, and publications. Where resumes are extensive, summaries that focus on the most relevant experience and publications are suggested. List all other commitments that key personnel have during the proposed period of contract performance.

(f) **Relationship with Future R&D.** Discuss the significance of the Phase I effort in providing a foundation for the Phase II R&D effort. Also state the anticipated results of the proposed approach, if Phases I and II of the project are successful.

(g) **Facilities and Equipment.** The conduct of advanced research may require the use of sophisticated instrumentation or computer facilities. The proposer should provide a detailed description of the availability and location of the facilities and equipment necessary to carry out Phase I.

(h) **Consultants and Subcontracts.** The purpose of this section is to convince NOAA that: (1) research assistance from outside the firm materially benefits the proposed effort, and (2) arrangements for such assistance are in place at the time the proposal is submitted.

Outside involvement in the project is encouraged where it strengthens the conduct of the research; such involvement is not a requirement of this solicitation.

1. Consultant - A person outside the firm, named in the proposal as contributing to the research, must provide a signed statement confirming his/her availability, role in the project, and agreed consulting rate for participation in the project. *This statement is part of the page count.*

2. Subcontract - Similarly, where a subcontract is involved in the research, the subcontracting institution must furnish a letter signed by an appropriate official describing the programmatic arrangements and confirming its agreed participation in the research, with its proposed budget for this participation. *This letter is part of the page count.*

(i) **Potential Commercial Application and Follow-on Funding Commitment.** Describe in detail the commercial potential of the proposed research, how commercialization would be pursued, benefits over present products on the market, and potential use by the Federal Government.

(j) **Cooperative Research and Development Agreements (CRADA).** State if the applicant is a current CRADA partner with NOAA, or with any other Federal agency, naming the agency, title of the CRADA, and any relationship with the proposed work.

(k) **Guest Researcher.** State if the applicant is a guest researcher at NOAA, naming the sponsoring laboratory.

(l) **Cost Sharing.** Cost participation could serve the mutual interest of NOAA and certain SBIR contractors by helping to assure the efficient use of available resources. Except where required by other statutes, NOAA does not encourage or require cost sharing on Phase I projects, nor will cost sharing be a consideration in evaluation of Phase I proposals.

3.4 Equivalent Proposals or Awards

A firm may have received other SBIR awards or elected to submit essentially equivalent proposals under other SBIR program solicitations. In these cases, a statement **must** follow the Technical Content section in the proposal indicating:

(a) the name and address of all agencies to which a proposal was submitted or from which an SBIR award was received;

(b) the date of proposal submission or date of award;

(c) the title, number, and date of the SBIR program solicitation under which a proposal was submitted or award received;

(d) the specific applicable research topic for each proposal submitted or award received;

(e) the title of the research project; and

(f) the name and title of the principal investigator for each proposal submitted or award received.

If no equivalent proposal is under consideration or equivalent award received, a statement to that effect **must** be included in this section.

3.5 Prior SBIR Phase II Awards

If a small business concern has received one or more Phase II awards from any of the Federal agencies in the prior 5 fiscal years, it must submit on a separate page, the names of awarding agencies, dates of awards, funding agreements numbers, amounts, topics or subtopic titles, follow-on agreements amounts, sources and dates of commitments, and current commercialization status for each Phase II. This required information shall not be part of the page count limitation.

3.6 Proposed Budget

Complete the "NOAA/SBIR Proposal Summary Budget" (Section 9.3) for the Phase I effort, and include it as the last page of the proposal. Some items of this form may not apply. Enough information should be provided to allow NOAA to understand how the offeror plans to use the requested funds if the contract is awarded. A complete cost breakdown should be provided giving labor rates, proposed number of hours, overhead, G&A, and profit. A reasonable profit will be allowed. When proposing travel, identify the number of trips, people involved, labor categories, destination of travel, duration of trip, commercial air fare or mileage rate, per diem expenses, and purpose of travel. Budgets for travel funds must be justified and related to the needs of the project. Where

equipment is to be purchased, list each individual item with the corresponding cost. The inclusion of equipment will be carefully reviewed relative to need and appropriateness for the research proposed. Equipment is defined as an article of nonexpendable, tangible property having a useful life of more than 1 year and an acquisition cost of $5,000 or more per unit.

SBA Policy requires that NOAA not issue SBIR awards that include provisions for subcontracting any portion of the contract back to the originating agency or any other Federal Government agency or to other units of the Federal Government. Requests for waivers from this requirement must be sent to the NOAA program manager.

For Phase I, a minimum of two-thirds of the research and/or analytical effort must be performed by the proposing firm. The total cost for all consultant fees, facility leases, usage fees, and other subcontract or purchase agreements may not exceed one-third of the total contract. For Phase II, one-half of the research and/or analytical effort must be performed by the proposing firm.

4.0 METHOD OF SELECTION AND EVALUATION CRITERIA

4.1 Introduction

All Phase I and II proposals will be evaluated on a competitive basis. Each Phase I proposal will be screened by NOAA to ensure that it meets the administrative requirements outlined in Section 4.2. Proposals that meet these requirements will be peer reviewed, undergo competition within each laboratory, and may also undergo a third round of competition across the agency.

4.2 Phase I Screening Criteria

To avoid a misunderstanding, small businesses are cautioned that Phase I proposals not satisfying all the screening criteria shall be returned without peer review and eliminated from consideration for a contract. Proposals may not be resubmitted (with or without revision) under this solicitation. All copies of proposals that fail the screening process will be returned. The screening criteria are:

(a) The proposing firm must qualify as a small business (Section 2.1). If it is a subsidiary of another firm, this limit applies to all employees under control of the parent organization.

(b) The Phase I proposal must meet **all** of the requirements stated in Section 3.

(c) The Phase I proposal must be limited to one subtopic and clearly address research for that subtopic.

(d) **Phase I proposal budgets must not exceed $75,000 (except subtopics with the suffix "SG", which are limited to $50,000).**

(e) **The project duration for the Phase I research must not exceed 6 months beginning on the contract start date.**

(f) A minimum of two-thirds of expenditures under each Phase I project must be carried out by the proposing firm.

(g) The proposal must contain information sufficient to be peer reviewed as research.

4.3 Phase I Evaluation and Selection Criteria

Phase I proposals will be rated by NOAA and/or external scientists or engineers with equal consideration given to the following criteria, except for item (a), which will receive twice the value of any of the other items:

(a) The scientific and technical merit of the Phase I research plan and its relevance to the objectives, with special emphasis on its innovativeness and originality.

(b) Importance of the problem or opportunity and anticipated benefits of the proposed research to NOAA, and the commercial potential, if successful.

(c) How well the research objectives, if achieved, establish the feasibility of the proposed concept and justify a Phase II effort.

(d) Qualifications of the principal investigator(s), other key staff, and consultants, and the probable adequacy of available or obtainable instrumentation and facilities.

Technical reviewers will base their ratings on information contained in the proposal. It cannot be assumed that reviewers are acquainted with any experiments referred to, key individuals, or the firm.

Final award decisions will be made by NOAA based upon ratings assigned by reviewers and consideration of additional factors, **including possible duplication of other research,** the importance of the proposed research as it relates to NOAA needs, and the availability of funding. NOAA may elect to fund several or none of the proposals received on a given subtopic. Approximately one-third of subtopic areas are generally funded in this solicitation. Upon selection of a proposal for a Phase I award, NOAA reserves the right to negotiate the amount of the award.

4.4 Phase II Evaluation and Selection Criteria

The Phase II proposal will undergo NOAA and external peer review for the purpose of determining overall technical or scientific merit. Review panels (one for subtopics identified as "SG", and one for all other subtopics), composed of senior technical specialists, will make the final Phase II selection decision based on the written reviews and the company presentation to the panel. Each of the following evaluation criteria will receive approximately equal weight, except for item (a), which will receive twice the value of any of the other items:

(a) The scientific and technical merit with emphasis on innovation and originality.

(b) Degree to which the Phase I objectives were met.

(c) The commercial potential of the proposal as evidenced by: a) a record of commercialization, b) the existence of Phase II funding commitments from non-SBIR sources, c) existence of Phase III follow-on commitments, and d) the presence of other indications of commercial potential of the research.

(d) The adequacy of the Phase II objectives to meet the problem or opportunity.

(e) The qualifications of the principal investigator and other key personnel to carry out the proposed work.

Upon selection of a proposal for Phase II award, NOAA reserves the right to negotiate the amount of the award. NOAA is not obligated to fund any specific Phase II proposal.

4.5 Release of Proposal Review Information

After final award decisions have been announced, the technical evaluations of a proposal will be provided to the proposer only upon written request and for a period not to exceed 90 days. The identity of the reviewers will not be disclosed.

5.0 CONSIDERATIONS

5.1 Awards

Contingent upon availability of funds, NOAA anticipates making about **15** Phase I firm-fixed-price contracts of no more than **$75,000** each (except for subtopics with the suffix “SG”, which are limited to $50,000). Performance period, with no exception, shall be no more than 6 months beginning on the contract start date. Historically, NOAA has funded about ten percent of the Phase I proposals submitted which is approximately one-third of the subtopic areas.

Phase II awards shall be for no more than $300,000 (except for subtopics with the suffix “SG”, which are limited to $200,000). The period of performance in Phase II will depend upon the scope of the research, but should not normally exceed 24 months.

It is anticipated that **approximately one-third of the Phase I awardees will receive Phase II awards,** depending upon the availability of funds. To provide for an in-depth review of the Phase I final report and the Phase II proposal and commercialization plan, Phase II awards will be made approximately 7 months after the completion of Phase I.

For planning purposes, proposers should understand that Phase I awards are made in July, Phase II proposals are due the following February, and Phase II awards are made during August and September.

This solicitation does not obligate NOAA to make any awards under either Phase I or Phase II. Furthermore, NOAA is not responsible for any monies expended by the proposer before award of any contract resulting from this solicitation.

5.2 Reports

Six copies of a final report on the Phase I project shall be submitted to NOAA upon completion of the Phase I research. The final report shall include a single-page project summary as the first page, identifying the purpose of the research, and giving a brief description of the research carried out, the research findings or results, and the commercial applications of the research in a final paragraph. The remainder of the report should indicate in detail the research objectives, research work carried out, results obtained, and estimates of technical feasibility.

All final reports must carry an acknowledgment on the cover page such as: "This material is based upon work supported by the Department of Commerce under contract number_____. Any opinions, findings, conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the Department of Commerce."

Progress reports in a brief letter format will be required also.

5.3 Payment Schedule

The specific payment schedule (including payment amounts) for each contract will be incorporated into the contract upon completion of negotiations between the Government and the successful Phase I or Phase II contractor. Progress payments are normally scheduled.

5.4 Proprietary Information, Inventions, and Patents

5.4.1 Limited Rights In Information and Data

Information contained in unsuccessful proposals will remain the property of the proposer, except that the “Project Summary” page may be made available to a limited audience through the SBA Tech-Net system. The Government may, however, retain copies of all proposals. Any proposal which is funded will not be made available to the public, except for the "Project Summary" page.

The inclusion of proprietary information is discouraged unless it is absolutely necessary for the proper evaluation of the proposal.

Proprietary information submitted to NOAA will be treated in confidence, to the extent permitted by law, if it is confined to a separate page with a numbering system key, and marked with a legend reading: "Following is proprietary information which (name of proposing firm) requests not be released to persons outside the Government, except for purposes of evaluation."

Any other legend will be unacceptable to NOAA and may constitute grounds for return of the proposal without further consideration. Without assuming any liability for inadvertent disclosure, NOAA will limit dissemination of such information to its employees and, where necessary for evaluation, to outside reviewers on a confidential basis.

Since technical reports may eventually be made available to the public, such reports shall not contain any language limiting their use other than for SBIR data as described below.

5.4.2 Copyrights

The contractor may normally establish claim to copyright any written material first produced in the performance of an SBIR contract. If a claim to copyright is made, the contractor shall affix the applicable copyright notice of 17 U.S.C. 401 or 402 and acknowledgment of Government sponsorship (including contract number) to the material when delivered to the Government, as well as when the written material or data are published or deposited for registration as a published work in the U.S. Copyright Office. For other than computer software, the contractor gives to the Government, and others acting on its behalf, a paid-up, nonexclusive, irrevocable, worldwide license to reproduce, prepare derivative works, distribute copies to the public, and perform publicly and display publicly, by or on behalf of the Government.

For computer software, the contractor gives to the Government, and others acting on its behalf, a paid-up, nonexclusive, irrevocable, worldwide license for all such computer software to reproduce, prepare derivative works, and perform publicly and display publicly, by or on behalf of the Government.

5.4.3 Data Rights

Except for copyrighted data, the Government shall normally have unlimited rights to data in Phase I, II, or III awards, such as:

(a) data specifically identified in the SBIR contract to be delivered without restriction;

(b) form, fit, and function data delivered under the contract;

(c) data delivered under the contract that constitute manuals or instructions and training material for installation, operation, or routine maintenance and repair of items, components, or processes delivered or furnished for use under the contract; and

(d) all other data delivered under the contract unless identified as SBIR data.

According to Federal Acquisition Regulation 52.227-20, Rights and Data - SBIR Program (March 1994), the contractor is authorized to affix the following "SBIR Rights Notice" to SBIR data delivered under the contract:

SBIR RIGHTS NOTICE

These SBIR data are furnished with SBIR rights under Contract No._____ (and subcontract_____, if appropriate). For a period of 4 years after acceptance of all items to be delivered under this contract, the Government agrees to use these data for Government purposes only, and they shall not be disclosed outside the Government (including disclosure for procurement purposes) during such period without permission of the contractor, except that, subject to the forgoing use and use by support contractors. After the aforesaid 4-year period, the Government has a royalty-free license to use, and to authorize others to use on its behalf, these data for Government purposes, but is relieved of all disclosure prohibitions and assumes no liability for unauthorized use.

(END OF NOTICE)

The Government's sole obligation with respect to any properly identified SBIR data shall be as set forth in the paragraph above. The 4-year period of protection applies for Phases I, II, and III.

5.4.4 Patents

Small business firms normally may retain the worldwide patent rights to any invention made with NOAA support. As described in more detail in FAR 52.227-11, NOAA receives a royalty-free license for Federal Government use, reserves the right to require the patent holder to license others in certain circumstances, and requires that anyone exclusively licensed to sell the invention in the United States must substantially manufacture it domestically. To the extent authorized by 35U.S.C.205, NOAA will not make public any information disclosing a NOAA-supported invention to allow the contractor a reasonable time to pursue a patent (less than 4 years). SBIR awardees must report inventions to NOAA within 2 months of the inventor’s notice to the awardee.

5.5 Awardee Commitments

Upon the award of a contract, the contractor will be required to make certain legal commitments. The outline that follows illustrates the types of provisions that will be included in the Phase I contract.

(a) Standards of Work. Work performed under the contract must conform to high professional standards.

(b) Inspection of Work. Work performed under the contract is subject to Government inspection and evaluation at all reasonable times.

(c) Examination of Records. The Comptroller General (or a duly authorized representative) shall have the right to examine pertinent records of the contractor involving transactions related to this contract.

(d) Default. The Government may terminate the agreement if the contractor fails to perform the work contracted.

(e) Termination for Convenience. The contract may be terminated at any time by the Government if it deems termination to be in the best interest, in which case the contractor will be compensated for work performed and for reasonable termination costs.

(f) Disputes. Any dispute about the contract, which cannot be resolved by agreement, shall be decided by the Contracting Officer with right to appeal.

(g) Contract Work Hours. The contractor cannot require an employee to work more than 8 hours a day or 40 hours a week, unless the employee is compensated accordingly (i.e., receives overtime pay).

(h) Equal Opportunity. The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin.

(i) Affirmative Action for Veterans. The contractor will not discriminate against any employee or applicant for employment because he or she is a disabled veteran or veteran of the Vietnam era.

(j) Affirmative Action for the Handicapped. The contractor will not discriminate against any employee or applicant for employment because he or she is physically or mentally handicapped.

(k) Officials Not to Benefit. No Government official shall benefit personally from any SBIR contract.

(l) Covenant Against Contingent Fees. No person or agency has been employed to solicit or secure the contract upon an understanding for compensation, except bona fide employees or commercial agencies maintained by the contractor for the purpose of securing business.

(m) Gratuities. The contract may be terminated by the Government if any gratuity has been offered to any representative of the Government to secure the contract.

(n) Patent Infringement. The contractor shall report each notice or claim of patent infringement based on the performance of the contract.

(o) American-Made Equipment and Products. When purchasing either equipment or a product with funds provided through the contract, purchase only American-made equipment and products to the extent possible, in keeping with the overall research needs of the project.

5.6 Additional Information

(a) Projects--The responsibility for the performance of the principal investigator, and other employees or consultants who carry out the proposed work, lies with the management of the organization receiving an award.

(b) Organizational Information--Before award of an SBIR contract, the Government may request the proposer to submit certain organizational, management, personnel, and financial information to assure responsibility of the proposer.

(c) **Duplicate Awards--If an award is made under this solicitation, the contractor will be required to certify that he or she has not previously been, nor is currently being, paid for essentially equivalent work by any agency of the Federal Government. Severe penalties may result from such actions.**

(d) **It is recommended that upon submission of your proposal you obtain a Dun & Bradstreet Number. You will need this number to be eligible to receive an award. You can obtain this number free of charge by contacting Dun and Bradstreet by phone at 1-800-333-0505 or on-line at** https://eupdate.dnb.com/requestoptions.html.

This program solicitation is intended for informational purposes and reflects current planning. If there is any inconsistency between the information contained herein and the terms of any resulting SBIR contract, the terms of the contract are controlling.

5.7 Research Projects with Human Subjects, Human Tissue, Data or Recordings Involving Human Subjects

Any proposal that includes research involving human subjects, human tissue, data or recordings involving human subjects must meet the requirements of the Common Rule for the Protection of Human Subjects, codified for the Department of Commerce at 15 CFR Part 27. Any questions regarding these requirements should be addressed to Dr. Joseph M. Bishop. Telephone: (301) 713-3565 or e-mail: joseph.bishop@noaa.gov.

5.8 Research Projects Involving Vertebrate Animals

Any proposal that includes research involving vertebrate animals (including fish) must be in compliance with the National Research Council's "Guide for the Care and Use of Laboratory Animals" which can be obtained from National Academy Press, 2101 Constitution Avenue, NW, Washington, D.C. 20055. In addition, such proposals must meet the requirements of the Animal Welfare Act (7 U.S.C. 2131 et seq.), 9 CFR Parts 1, 2, and 3, and if appropriate, 21 CFR Part 58. These regulations do not apply to proposed research using pre-existing images of animals or to research plans that **do not** include live animals that are being cared for, euthanized, or used by the project

participants to accomplish research goals, teaching, or testing. These regulations also do not apply to obtaining animal materials from commercial processors of animal products or to animal cell lines or tissues from tissue banks.

6.0 SUBMISSION OF PROPOSALS

6.1 Deadline for Proposals

Deadline for Phase I proposal receipt (6 copies) at the Contract Administration Branch is noon (EST) on January 14, 2004.

NOAA assumes no responsibility for evaluating proposals received after the stated deadline or that do not adhere to the other requirements of this solicitation (see checklist at back). Such proposals may be returned to the proposer without review.

Federal Acquisition Regulation (FAR 52 215-1) regarding late proposals shall apply. Letters of instruction will be sent to those eligible to submit Phase II proposals. The Phase II proposals are due at about the same time as Phase I final reports - 7 months after commencement of the Phase I contract.

Proposers are cautioned to be careful of unforeseen delays which can cause late arrival of proposals at NOAA, resulting in them not being included in the evaluation procedures. No information on the status of proposals under scientific/technical evaluation will be available until formal notification is made.

6.2 Proposal Submission

Hardcopy submission of NOAA proposals should be sent in 6 copies to:

ATTN: SBIR Proposals
U.S. Department of Commerce, NOAA
Contract Administration Branch, Code OFA66
1305 East-West Highway, SSMC4, Station 7604
Silver Spring, MD 20910-3281
Telephone: (301) 713-0838

For local delivery, the Contract Administration Branch is located near the intersection of East-West Highway and Colesville Road, and close to the Silver Spring Metro stop.

Acknowledgment of receipt of a proposal by NOAA will be made. All correspondence relating to proposals must cite the specific **proposal number** identified on the acknowledgment.

(a) **Packaging--Secure packaging is mandatory. NOAA cannot process proposals damaged in transit. All 6 copies of the proposal must be sent in the same package. Do not send separate "information copies," or several packages containing parts of a single proposal, or two packages of 6 copies of the same proposal. The top copy must be signed as an original by the principal investigator and the corporate official. Other copies may be photocopies.**

(b) Bindings--**Do not use special bindings or covers.** Staple the pages in the upper left hand corner of each proposal. Separation or loss of proposal pages cannot be the responsibility of NOAA.

6.3 Warning

While it is permissible, with proper notification to NOAA, to submit identical or essentially equivalent proposals for consideration under numerous Federal program solicitations, it is unlawful to enter into contracts requiring essentially equivalent effort. If there is any question concerning this, it must be disclosed to the soliciting agency or agencies before award.

7.0 SCIENTIFIC AND TECHNICAL INFORMATION SOURCES

7.1 General Information

The following web pages may be sources for additional technical information:

http://www.NOAA.gov http://www.lib.noaa.gov

7.2 Oceanography and Marine Science

Scientific information in the areas of oceanography and marine science may be obtained from organizations shown in the website http://www.nsgo.seagrant.org/SGDirectors.html

8.0 RESEARCH TOPICS

8.1 TOPIC: ATMOSPHERIC SCIENCES

8.1.1R Subtopic: Small Balloon for Atmospheric Research and Homeland Security Applications

A small, hand-launched balloon that could carry instrumentation through the lower atmosphere would find great use in NOAA's atmospheric research programs and would have a logical extension to homeland security. To fulfill the research and operational needs, this balloon must have the capability to change its float altitude either in a pre-programmed way or upon command from the ground. This would allow the balloon to drift at a constant level with the mean flow and provide Lagrangian type measurements along the streamlines. Using the same equipment, the balloon could be programmed to repeatedly ascend and descend as it drifted through the region of interest and thus obtain profile type of measurements. Data would be sent to the ground by a radio link. The measurements would include the standard atmospheric parameters as well as parameters relating to chemical, biological, or radiological (CBR) measurements depending on the availability of suitable transducers and the specific application.

The recipient of this Small Business Innovative Research contract should have some knowledge of ballooning. This knowledge must be combined with innovative research to conduct a thorough study and produce a small balloon concept.

The balloon and payload should be able to conduct missions of 12 hours or less and be able to ascend to about 6 km above sea level. It should be capable of being prepared and launched by a single person with minimal training. The balloon shall be capable of flying at a constant altitude or a constant density level depending on how it is configured. It should also be capable of ascending and descending a number of times to take measurements through a region of the atmosphere. Only helium lifting gas need be considered as hydrogen gas would be hazardous for an application where inexperienced persons may be involved.

8.1.2R Subtopic: Design of a Cylindrcal Optical Detection System for a Charged Coupled Device (CCD) Camera Lidar

An innovative lidar (laser radar) method for measuring aerosols in the boundary layer has been developed at Mauna Loa Observatory. The intent of the research is to provide an inexpensive method of monitoring boundary layer aerosols with high spatial resolution from the ground throughout the boundary layer. This type of monitoring is needed to access the impact of anthropogenic and natural aerosols on climate. The aerosols directly effect solar radiation and indirectly effect cloud properties, which can be a significant regional climate force by cooling the atmosphere.

The system has been tested with a large laser (Barnes et. al., 2003) but a new detector system is needed with much greater light gathering power, so the measurements can be made with a much smaller, eye-safe laser. This solicitation is for an optical design of the collecting mirror (or lens), bandpass filters, shutter and CCD camera. The field of view must be 100 degrees in the vertical to image a laser beam from the ground up, but only a few degrees in the horizontal. This suggests cylindrical optics to gather the light. The light must then be imaged through narrow bandpass filters onto the CCD camera. A shutter is also desired to block background light between pulses of the laser.

The innovative design would require optical ray-tracing, experience in optical design, and a knowledge of off-the-shelf or easily made optical components. The system would need to work with ultraviolet, visible, and near infrared wavelengths.

Reference:

Barnes, J.E., S. Bronner, R. Beck, and N.C. Parikh, May 2003, Boundary layer scattering measurements with a CCD camera lidar. Applied Optics, 42: 2647-2652.

8.1.3R Subtopic: Atmospheric Variables in the Open Ocean Surface Environment

The NOAA Office of Global Programs has broad interest in the measurement of atmospheric variables in the open ocean marine surface environment. A small, integrated weather station equipped with a standard meteorological suite of instruments complemented by a ceilometer, horizontal visibility sensor, and general cloud cover sensor that could be deployed on a Volunteer Observing Ship and NOAA research vessels and marine buoys would provide a valuable source of in-situ observations that could be used in a wide variety of climate studies, as well as provide critical calibration information for meteorological satellite observations. The system should include a Global Positioning System and communications capabilities, including ARGOS Satellite Service, and needs to offer ease of installation, operations, and maintenance.

8.1.4R Subtopic: Robust High Precision Analyzers for Atmospheric Carbon Monoxide

Rising concentrations of greenhouse gases in the atmosphere due to human activities are posing an increased risk of global climate change. Carbon monoxide has increased since pre-industrial times, and plays a major role in atmospheric chemistry, influencing the chemical life time and build up of many other trace gases in the atmosphere. The Kyoto Protocol in 1998 was a first step toward international agreements limiting the emissions of several greenhouse gases and fostering the sequestration of carbon on the land or in the oceans. Carbon monoxide is an important tracer for the diagnosis of the anthropogenic component of precise atmospheric carbon dioxide measurements. The North American Carbon Program calls for, as its highest priority near-term enabling development, the development of accurate in-situ sensors and sampling protocols for atmospheric measurements of CO2, CO, and CH4, http://www.esig.ucar.edu/nacp/. Robust instrumentation for CO2 and CH4 is already under development.

Specifications for the CO analytical systems are as follows. The systems would measure the mole fraction of CO in dry air, they would require very little maintenance for extended periods of field use, up to half a year, and would be operable by people without extensive scientific training. It is acceptable to use ambient air reference gas mixtures for periodic automated calibration of the instruments, but the amount of gas required should be kept below 1 liter (NTP) per day. The accuracy requirement (with reference gases if used) is 1 ppb. Precision (repeatability) is 10 ppb in one minute (~5-10% of CO in ambient clean air) or better. The instrument should not be not sensitive to motion. Preliminary estimates of sales price and cost breakdown for a full analytical system, if manufactured in quantity, is required.

8.1.5R Subtopic: Airborne Lightweight Gas Chromatograph for Greenhouse Gases

Climate forcing by greenhouse gases is considered to be one of the most important environmental problems in this century. NOAA requires a unique lightweight instrument to support the North American Carbon Program (NACP, see page 15 of http://www.esig.ucar.edu/ncap/ to measure hydrogen (H_2), methane (CH_4), and carbon monoxide (CO) in the troposphere from 0 to 10km in altitude. These measurements are to support a Carbon America experiment by NOAA's Climate Monitoring and Diagnostics Laboratory (CMDL) in Boulder, Colorado to fly small general aviation-type aircraft at about 30 locations across the United States about twice a week. The primary measurement of the experiment is carbon dioxide (CO_2), the most important greenhouse gas. An airborne gas chromatograph (GC) will provide additional information in support of this experiment. A GC is an instrument that utilizes the physical separation of the gas of interest from air and detection to quantify trace concentrations (parts-per-billion, ppb) of gases. This GC will measure two other important carbon gases including CH_4, a significant greenhouse gas, and CO, a trace gas used as a proxy to remove the component of fossil fuel combustion from the CO_2 measurement. Hydrogen is also separated on the same column and has a significant soil sink that could provide land use information.

NOAA/CMDL scientists have a rich heritage over the past 12 years of developing gas chromatographs on airborne platforms and at fixed ground-based sites. The technology to build airborne GCs is well understood and documented in the scientific literature (author search: Elkins). The gas chromatograph requires a carrier gas of nitrogen to constantly move samples into the separation columns and small flows of nitrous oxide doped into the electron capture detector (ECD). Constant temperature control of the separation column and detector are required. The flows of the carrier gas and doping gas must also be constant. Constant pressure must also be maintained in the ECD. Computer control of sampling flows, temperatures, and valves is also required. Detection of peaks from the detector must be completed by the same data system. The height or area of the peak is directly proportional to the concentration of the trace gas under study. The first goal is to build a prototype of a one-channel gas chromatograph to measure atmospheric concentrations of H_2, CH_4, and CO using a nitrous oxide-doped ECD in a small compact package. The final goal is to produce thirty units for an estimated cost at around $30-40K each. It would be possible to measure at least 15 different trace gases with this instrument by appropriate changes in separation columns, temperature and flow programming, and doping gases. We anticipate a large potential additional market for these instruments that will include university, corporate, and government researchers conducting biological field investigations, air quality studies, and airborne studies.

8.1.6R Subtopic: Detectors and Filters for Solar EUV Observations

There is a NOAA requirement for the observation of solar EUV irradiance from 1 to 130 nm in 10-30 nm wide bands. The wavelengths from 1 to 50 nm and the band around 120 nm have been achievable with combinations of filters and transmission gratings. Observations of the wavelengths between 50 and 100 nm have proven to be more problematic. The combination of gratings, thin metal filters, and silicon diode detectors have either proven to be unstable over the required 5-7 year life of the mission, or the filter/grating combination has not blocked enough visible light to allow the EUV signal to dominate.

Alternative filters, detectors, and/or wavelength isolation techniques need to be explored for use in space-based solar EUV sensor systems. These are required for the NOAA GOES (Geosynchronous Operational Environmental Satellite) mission. The sensor systems should provide a method of measuring 10-20 nm wide bands between 50 and 100 nm with high levels of accuracy and repeatability through the entire dynamic range of the solar EUV flux levels. They should be stable in the geosynchronous space environment for more than seven years. They should reduce the visible light signal in the detector to a level that contributes only a small faction to the total signal.

8.1.7R Subtopic: Space Weather Industry

A significant demand for space weather information that can be affected by extraterrestrial radiation is anticipated as high-tech systems that are being brought on-line. Companies in the business of selling and supporting satellite constellations, cellular phone transmission, space travel, and power distribution, to name a few, will require space "weather" forecasts, improved models, and data. In order to meet these demands, NOAA is seeking innovative models and products for users. In developing such concepts it will be useful to consider the embryonic space weather industry as an analog to present developments in the meteorological and communications industries. The National Weather Service now supports a growing private industry based on its data and services. The purpose of this solicitation is to request proposals that will assist private industry in the development of space weather services. An understanding of the type of products that are now available can be obtained in products shown on NOAA Weather Wire space weather products, and at the Website at http://www.sec.noaa.gov/Data. Most of the data that are available to companies that wish to develop space weather services is on the Website.

8.1.8R Subtopic: Global Universal Profiling System Profiling Net Radiometer

The Global Universal Profiling System (GUPS) proposed by the NOAA Research's Forecast Systems Laboratory includes a provision for profiling solar and thermal radiation from launch altitudes near 18,000 m to the surface. The web page http://www.fsl.noaa.gov/gups/index.html gives an overview of the proposed plan.

A radiometer that is capable of measuring net vertical radiation (0.25 to 100 micrometers) accurately over this altitude range anywhere in the world must operate over a temperature range between –90 and 45 deg C and pressures between 20 and 1060 hectopascals. Long-range planning includes drops with roughly 10 degrees of separation over the oceans and arctic regions once every three days. Consequently, a low per item production cost is essential for this application.

Other requirements include:
Weight (< 1.0 kg)
1/e response time (< 2 secs
Provision for measurement of orientation
Accuracy (95% confidence) – 8 W/m^2 for net, <5 W/m^2 for individual components
Per item production cost - < $1000 US
Consideration will be given to proposals that include provisions for the separation of broadband solar and thermal infrared wavelengths, as well as up welling and down welling components.

The radiometer may be incorporated into existing or developing meteorological

dropsondes provided the radiometer's view has minimal obstruction from the other sensors and chute, or the radiometer may fly as a stand-alone dropsonde unit with its own data acquisition and telemetry.

8.1.9R Subtopic: Airborne Instrument for Measuring Particle Optical Size and Mixing State

The direct effect of natural and anthropogenic aerosol particles on the atmospheric radiation budget is an area of significant uncertainty in predicting global climate. The atmospheric aerosol is often composed of a variety of compounds and morphologies that may be present as internal mixtures (compounds are mixed together in particles) or external mixtures (individual particles have different compositions and/or morphologies). The size, refractive index, shape and mixing state of the particles in part controls their radiative impacts. To improve understanding of the sources, transformations, mixing state, and physical and optical properties of atmospheric aerosol particles, NOAA is seeking a lightweight, autonomous, and robust instrument that makes accurate measurements of particle size distributions while simultaneously providing information on the shape, density and/or refractive index of the particles.

Specifications for the instrument include the ability to make highly resolved optical measurements of particle size distributions over a diameter range of at least 0.1-1.0 μm, with a single-valued response over this range, preferably using a broad-visible-spectrum light source. Uncertainties in particle diameter for a range of realistic atmospheric refractive indices should not exceed ±15%. The instrument should also be capable of identifying single particles with different shapes, densities, and/or refractive indices. The technique should not substantially alter the extensive chemical properties of the aerosol, and ideally should allow extraction of the aerosol stream for further analysis of the particles with downstream chemical detectors. Because this sensor is being developed for airborne field missions, it should be light, small, and consume modest power at voltages available on research aircraft.

8.1.10R Subtopic: Advanced Microwave Antenna for Airborne Soil Moisture and Salinity Mapping

Wide-area mapping of the two environmental variables (i) soil moisture and (ii) salinity are important for (i) drought monitoring, boundary layer modeling, flash flood prediction, and agriculture, and (ii) estuary and coastal ecosystem monitoring and biodiversity studies. These variables are both able to be mapped from aircraft using scanning radiometer systems operating in the wavelength range from P- to C- band. The addition of radar at or near these bands is desirable for improving sensitivity. The mapping requires large antenna structures that are able to be either scanned mechanically or beam steered, and of appropriate aerodynamic form, narrow beamwidth, and high efficiency. Dual polarization capability is also desirable to improve sensitivity, especially for salinity.

This SBIR request by the Environmental Technology Laboratory seeks to develop a multi-band and dual-polarized flat-panel antenna for use as an airborne conically-scanning imaging subsystem. The antenna should have thin cross-section and be mechanically suited to be used inside a highly oblate (10:1) ellipsoidal radome. The antenna should provide the capability of operating with high efficiency (>70%) simultaneously at L-band (1400-1427 MHZ) and C-band (6.0-6.5 GHz), and with both

vertical and horizontal polarization capability. The antenna should have a main beam pointed approximately 45 degrees off of the ellipsoid axis to facilitate conical mapping by rotation of the ellipsoid and antenna around the vertical axis. Successful development of this antenna should lead to new and practical hardware for precision airborne mapping of soil moisture and salinity.

8.2 TOPIC: OCEAN OBSERVATION SYSTEMS

8.2.1N Subtopic: Operational Ocean Instrumentation, Measurements, and Data/Information Dissemination Systems

Development of operational ocean instrumentation, measurement, and data/information dissemination systems is sought to support a wide range of NOAA's National Ocean Service (NOS) operational activities, such as the Physical Oceanographic Real-Time System (PORTS) Program, the National Water Level Observation Network (NWLON) Program, coastal and estuarine forecast systems, and environmental monitoring associated with sustaining healthy coasts and mitigation of coastal hazards. NOS requirements include systems for short-term (hours to weeks) deployment to support specific scientific projects as well as systems for long term (months to years) deployment where they might be incorporated into existing monitoring sites (e.g., PORTS or NWLON). Development generally includes sensing, data acquisition, processing and analysis, and information dissemination. One emphasis area is for systems that can be operated in an unattended mode. These systems should provide near real-time data acquisition and dissemination. Another area of emphasis is remote sensing systems which allow rapid acquisition of data from large coastal areas. High reliability, known accuracy, and cost effectiveness are important design considerations. The parameters of interest are comprehensive, including (1) physical, chemical, and biological properties of the coastal ocean environment; (2) pollutants; and (3) overlying atmospheric parameters. These systems provide marine environmental information in support of safe navigation, safe transportation of hazardous materials, economic benefits to marine commerce, management of marine resources, assessment of coastal ecosystems health, and mitigation of natural hazards.

Of particular interest this year are proposals relative to the following:

a) High Resolution Surface Current Mapping in Harbors -- The National Ocean Service has installed PORTS in many harbors to promote safe and efficient marine transportation. A primary requirement of the maritime community for these systems is the observation of water currents at selected locations. The Center for Operational Oceanographic Products and Services (CO-OPS) uses upward-looking Acoustic Doppler Current Profilers (ADCP) mounted on the bottom and cabled to shore. While this configuration provides a good current profile throughout the water column, it is a single-point observation that is relatively costly and difficult to maintain. In confined waterways with winding channels, the maritime community requires many more ADCPs than can be reasonably procured or maintained. For example, pilots identified fourteen locations in the Hampton Roads portion of the southern Chesapeake Bay alone. Remote sensing in the form of radar surface current mapping systems is an approach more suited to the spatial coverage required, but existing systems cover too wide an area with resolution too coarse for harbors and waterways. Existing shore-based High Frequency (HF) Doppler radar surface current mapping instruments cover up to 50 thousand square kilometers with a grid spacing of 6 x 6 kilometers, or as small as 150 square kilometers with a grid spacing of as little as 200 x 200 meters (See http://www.codaros.com/products/HiResSpecs.htm). CO-OPS seeks a robust sensing system to observe water currents on space and time scales suited to harbors, (i.e., order of 10 x 10 meter grid spacing, near real-time reporting at hourly or shorter time intervals), with errors less than 10 cm/sec. The ideal system must operate in both fresh and salt water, and under most conditions experienced in the harbor/bay environment. Preference is given to shore-based observations for ease of maintenance and access to

data. Another critical feature is that the system should be modestly priced in order to sustain a healthy commercial market.

b) Miniaturized Low Cost Electronic Oceanographic Sensors **--** Most of the kinds of information that coastal scientists want to collect can be obtained using conventional field instruments that are either moored in place or mobile between sampling sites. These measurements could include salinity, temperature, dissolved oxygen concentration, turbidity, wave height, fluorescence, beam attenuation, and light backscatter measurements. Currently, such instruments may range in price from one to twenty-five thousand dollars or more, depending on how many variables they are capable of measuring. A useful addition to the array of instruments would be low cost packages that can measure and record one or more variables in situ over a short time interval (e.g., hours, days, or weeks). If these small packages were relatively inexpensive and reusable, investigators could leave them at a sampling site for short periods without risking too much and without investing too much in instrumentation to cover multiple sites. Currently data density is limited by cost constraints for instrumentation, but it should be driven by the phenomenon of interest.

c) Systems for Remote Sensing of In-Situ Optical Properties – Optical techniques are amenable to a variety of platforms (satellites, aircrafts, mooring, and profiling instrumentation) allowing researchers to design multi-platform sampling networks capable of collecting data over ecologically relevant scales. The relevant inherent optical properties include absorption, attenuation and scattering, which can be combined with spectral fluorescence. Emphasis should also be on making the measurements with as much spectral information as possible. An ideal system would allow for the archival, storage and manipulation of terabytes of information, which would allow researchers to analyze and distribute products to scientists in the field. Such a system would have a friendly web-based interface that would allow for easy access and retrieval of data over large sections of the coast for easy integration with in situ data.

d) Video Recorder to Image Microzooplankton and Fish -- A towed video instrument for surveying and identifying macrozooplankton and micronekton in the water column is needed. The device will fill a scale gap between existing imaging instruments designed for small particles and zooplankton, such as the Video Plankton Recorder, and existing acoustic systems, which have greater range but lack the ability to identify different taxa of organisms. Needed is a device that will illuminate and image objects ranging from 0.5 to 100 cm in size, within a field of view ranging from 2 to 4 m^2. Towed , the instrument would survey volumes of water approaching those filtered by mid-water trawls, and would operate to full ocean depth. Concurrent environmental data will include depth, temperature, salinity, fluorescence, oxygen, and ambient light. Power, operational data, and video signals would be transmitted between the instrument and the surface.

e) Automated Detection of Harmful Algal Bloom Toxins and/or Toxigenic Species and Toxins – Methods for detecting harmful algal bloom (HAB) toxins and toxigenic species are generally laborious and require expensive laboratory equipment. In addition, it is now known that toxigenic HAB species may differ genetically and morphologically from region to region, making identification even more difficult. Recently molecular probes for toxic species and immunological techniques for the detection of toxins have moved toward more automated detection. Further modification of these technologies for use in the field is desired. These *in-situ*, autonomous sampling technologies might include genetic, immunological, and chemical methods placed on microchips, filter arrays, etc. Consideration should be given to accurate, rapid, and quantitative detection of toxins and toxigenic organisms specific to a given geographical region. Ideally, this

system would be capable of transmitting results autonomously in real-time to a remote location for data processing and interpretation.

8.2.2R Subtopic: Microsensors for Marine Chemical Measurements

Microsensors manufactured with techniques derived from the integrated circuit industry represent an opportunity to develop next-generation marine sensors with improved measurement capabilities at lower cost. The purpose of this research is to develop a prototype marine instrument deployable on fixed, towed or autonomous platforms capable of providing chemical compound identification and quantification. Identifying and quantifying the chemical compounds that make up marine nutrients and contaminants currently requires time consuming and costly field sample collection and laboratory analyses. Technologies such as quartz crystal microbalance, surface acoustic-wave, and silicon integrated circuit structures can be applied in the marine environment to allow direct extraction of data in the field or to provide survey information during field sampling efforts. These technologies do not employ colorimetric measurement requiring chemical reagents. Instrumentation utilizing this technology will be applicable to marine environmental research, environmental monitoring and municipal drinking water quality assessment.

Contaminants and nutrients of interest along with detection goals:

	Range	Resolution
Persistent Organic Contaminants	0-1 ppm	1 ppt
Phosphate	0.5-3.0 ug P/L	0.1 ug P/L
Silica	0.1-2.0 mg SiO2/L	0.1 mg SiO2/L
Nitrate-nitrogen (NO3)	0.01 - .5 mg N/L	0.01 mg N/L

8.2.3W Subtopic: Low maintenance Conductivity-Temperature Sensor

The National Data Buoy Center (NDBC) operates a network of moored buoys and fixed coastal marine stations, and manages the National Weather Service (NWS) Volunteer Observing Ship (VOS) Program. These platforms measure a variety of meteorological and oceanographic variables for the NWS for use in weather forecasting and climate prediction. NDBC installs meteorological and oceanographic sensor measurement packages on privately owned and commercial vessels as part of the VOS program which provide data to the National Oceanic and Atmospheric Administration (NOAA) from disparate geographical areas. Moored buoys, fixed coastal marine stations, and VOS are typically located in remote areas and see infrequent maintenance.

NDBC has increased the number of oceanographic measurements made from its platforms, and has recently added conductivity-temperature sensors to some platforms for measurements necessary to compute the salinity of ocean waters at selected stations. NDBC is installing a number of conductivity-temperature sensors on buoys and C-MAN stations as part of the Coastal-Global Ocean Observing System (C-GOOS). NDBC platforms with conductivity-temperature sensors are typically located in coastal waters, and VOS conductivity-temperature sensors are typically mounted on ship hulls near the surface of the ocean. These areas of the ocean are very active biologically, and

as a result, conductivity-temperature sensors become rapidly fouled with marine growth. Marine growth on existing technology conductivity-temperature sensors rapidly degrades the accuracy of the sensor necessitating frequent maintenance. In order to significantly reduce the frequency of costly maintenance service visits to NDBC platforms, NDBC is seeking a low- or no-maintenance conductivity-temperature sensor.

A review of salinity measurement requirements and technologies available for the coastal ocean is thoroughly discussed in [1]. A conductivity-temperature sensor for coastal measurements would have a computed salinity resolution of 0.01 parts per thousand, with a computed salinity accuracy of 0.1 parts per thousand. A low- or no-maintenance conductivity-temperature sensor would operate and maintain this computed salinity resolution and accuracy in the presence of marine growth and bio-fouling for a minimum of one year without maintenance and ideally operate in this environment to this accuracy for as long as three years.

References:

[1] Measurements of Salinity in the Coastal Ocean: A Review of Requirements and Technologies, Marine Technology Society Journal, vol. 34, no. 2, Summer 2000.

[2] National Data Buoy Center web site, http://www.ndbc.noaa.gov, for background information on NDBC and its programs.

8.2.4W Subtopic: Air Deployed-Self Moored-Expendable (ADSMEX) Buoy

The National Data Buoy Center (NDBC) maintains a network of nearly 80 moored buoys in the deep ocean and coastal zone around the United States. This observation network supports the National Weather Services' warning and forecast mission. Although NDBC plans for normal maintenance and exchange activities, there are unforseen outages or station losses that affect data availability at critical times. NDBC Discrepancy Response Policy requires (when practical, and consistent with safety guidelines) that service should be attempted within 4 weeks for coastal buoys, and 6 weeks for deep ocean buoys. Ship availability, weather, and other factors often cause negative impacts and prevent restoration of data in a reasonable time frame.

When a station fails, NDBC's ability to restore data is sometimes delayed for weeks or months due to circumstances beyond NDBC's control. Although drifting buoys may be a viable option to mitigate these delays, they have limitations. Several drifters of various types must be used to obtain all needed measurements, and the expense associated with purchasing many platforms requiring separate satellite communications services for more than one platform is excessive. Also, it can be difficult for operational forecasters to compare and analyze the various measurement parameters from multiple locations.

This Small Business Innovation Research (SBIR) request solicits the development of a cost-effective, expendable buoy capable of being air deployed from C-130 aircraft or ship of opportunity; mooring itself in 2,500 to 3,000 fathoms of water; reporting all critical parameters (wind speed and direction, wave data, barometric pressure); having hourly, event driven, or on-demand satellite communications with a GTS compatible format; and continuously operating for 6-12 months. Developing this kind of platform offers the opportunity for NDBC and NOAA to develop and implement new cost-effective mitigation strategies for data loss, enter more partnerships and data sharing agreements with other users, and obtain measurements from other regional observing networks in a common data format to benefit the Coastal Ocean Observation Program.

8.2.5R Subtopic: Velocity Measurement from a Buoy in an Open Ocean Environment

Proposals are requested to develop a remotely sensed, ultra-compact, physically-robust, low-cost, power-efficient, wind velocity sensor for a constantly moving platform.

Wind velocity is a critical parameter measured by ocean observing systems. Wind data from ocean buoys are used by meteorologists for improved weather prediction, validation of satellite wind observations, and in climate diagnostic models. Currently, wind velocity is measured from most buoys with mechanical or point acoustic anemometers that measure wind at the sensor location that is distorted by the surface roughness and boundary layer effects. This effect is pronounced in higher seas with smaller buoys. These sensors are also subject to vandalism because they are highly visible and mounted high on a tower on the buoy platform. Additionally, mechanical failures are commonly caused by salt spray getting into the delicate bearings, wave impacts, submergence, and incidental contact of fragile elements during launch and recovery.

Technical innovations are required in sensor design and packaging that would mitigate these deficiencies. For example, a sensor without mechanical moving parts, or any vertical protrusions from the buoy will reduce these problems immensely. Under these criteria the wind velocity must be sensed remotely in a few meter thick layer above the buoy at a distance of 10 to 50 meters. Horizontal wind speeds of up to 100 knots with an accuracy of +/- 0.2 meters per second and relative directionality of +/- 4 degrees are desired. A minimum of 6 sample points per hour is required. Sampling schemes would have to compensate for the motion of the platform by averaging many samples, or by using a platform attitude sensor. For small buoys, the wind sensor will need to be very compact, and to be able to withstand constant motion, vibrations, sudden accelerations, and be very power efficient because of space limitations for a battery pack. If, for example, each sample point used 0.02 watt-hour of energy, a reasonably sized battery pack could be accommodated. In addition, the sensor must be robust, easy to install and not require maintenance or calibration for long-term remote deployments, which could be greater than 3 years. Also, the wind sensor must be able to ignore velocity data contaminated by extraneous objects such as hydrometeors (rain, snow, hail), salt crystals, insects, and birds. If a laser-based sensor is selected, it should be eye-safe. The sensor projector, whether a transducer, antenna or lens, must fit into a circle 40 centimeters in diameter. The projector should ideally be light weight and present a relatively flat surface fabricated from UV and corrosion resistant materials. Cost of the production version must be in line (within a factor of 2) with other buoy wind sensors on the market.

Wind sensors are used all over the world, on land and water for scientific and commercial purposes. A compact, low-cost, power efficient, low maintenance unit that is easy to install and operate will find widespread use worldwide.

Reference:

Wilczak, J. M., E. E. Gossard, W. D. Neff, W. L. Eberhard, 1996. “Ground-Based Remote Sensing of the Atmosphere Boundary Layer: 25 Years of Progress,” Boundary-Layer Meteorology 78: 321-349.

8.2.6R Subtopic: Airborn Radar Sensor for Measurement of Ocean Wave Directional Spectra in Hurricanes

The NOAA Hurricane Research Division (HRD) has a requirement for observations of directional ocean wave spectra in hurricanes to improve parameterizations of air-sea fluxes for use in hurricane prediction models. NOAA National Hurricane Center (NHC) has a requirement to forecast the radius of 12 foot seas in hurricanes. Next-generation storm surge models being developed at NOAA National Center for Environmental Prediction (NCEP) require inputs from observed ocean directional wave spectra in real time.

Compact airborne remote sensing systems capable of real-time directional ocean wave spectra measurement can provide an effective and important input to the above requirements. In recent years a prototype high resolution 36 GHz scanning radar altimeter, referred to as the Scanning Radar Altimeter (SRA), has been tested on NOAA hurricane research aircraft. With post-flight processing, it provided the first comprehensive measurements of the sea surface directional wave spectrum in all quadrants of a hurricanes' inner core. Partitioning the wave spectra between various swell components and locally generated sea state enabled determination of the characteristics of the various components of the hurricane wave field and mapping of their spatial variation.

Recent advances in solid-state millimeter wave components and signal processing technology suggests that a compact, unattended system can be developed to provide real-time display of ocean surface wave spectra for operational monitoring of wave properties and air-sea interaction processes in hurricanes. In addition to providing a determination of the radius of 12-foot seas, as required by NHC, this information can provide insights into the coupling of energy at the air-sea interface required by HRD as well as improve the performance of other remote sensors of the hurricane environment. The Phase I effort should demonstrate the feasibility of an affordable, solid-state radar design prior to the fabrication of a complete system during Phase II. The system should operate unattended and have the capability to produce and display sea surface directional wave spectra in real-time and to transmit these spectra from the aircraft to NHC, HRD and NCEP for integration into storm prediction models

8.2.7E Subtopic: Remote Sensing of Coastal Phenomena

Information gained from space-based sensors has afforded scientists and managers a wealth of information concerning the world's oceans, coastal waters, and terrestrial areas. In most cases and with most space-based sensors, water/land contrast near the coast has dominated the remotely sensed signal, leaving little signal remaining to derive physical, biological, or littoral information. However, many of our natural resources and assets have a critical coastal component. For example, it would be advantageous to use remotely sensed imagery to determine the presence of undesirable agents within coastal waters at as low a concentration as possible. Such agents might include pollutants, chemical additives (such as fertilizers), bacteria, or other potentially hazardous materials. The process could be used to reduce the amount of more expensive *in situ* monitoring required in an area, or more effectively, use the monitoring assets already in place. Derived information must be highly reliable, accurate within identifiable boundaries, and cost-effective. Such a technique should be extremely valuable in support of coastal reserve areas, wetlands, and coastal fisheries.

8.3 TOPIC: Living Marine Resources

8.3.1F Subtopic: Containment Systems for Offshore Aquaculture in the Exclusive Economic Zone (EEZ)

Marine aquaculture is predicted to be a significant global industry for food production. Aquaculture , while developing rapidly in other developed countries and in Asia, has been slow to develop in U.S. Coastal waters because of competition for aquatic space. Off shore aquaculture , located in the EEZ will alleviate in shore problems through better dispersal of organic wastes, avoidance of navigational and recreational conflicts and will preserve the aesthetic values of inshore habitats. However, wind and wave stresses of the high energy in exposed offshore areas present significant technical challenges in the design and construction of secure containment systems required for the culture of fish and shellfish species.

The purpose of this topic is to further the development of and engineering of off shore aquaculture systems that can withstand sustained high wind and wave energy environments while providing an environment conducive to the propagation of emerging commercially valuable marine species in the EEZ.

Proposals should be directed to all aspects fo offshore containment systems including: evaluation and deployment, design of physical structures, computer and physical modeling of net pens (surface or submerged) and mooring systems, remotely operated vehicle and robotic techniques, remote monitoring technology feed delivery systems and harvesting devices, design of associated service vessels, and predator exclusion barriers.

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Funge-Smith, S. Phillips, M.J. 2001. Aquaculture systems and species. http://www.fao.org/DOCREP/003/AB412E/ab412e07.htm

Gulf of Mexico Offshore Aquaculture Consortium Abstracts 2002, http://www.msstate.edu/dept/crec/pubaqua.html

Puerto Rico at the Cutting Edge of Offshore Aquaculture, Snapper Farm, Inc. To learn more about offshore aquaculture projects and technology, http://www.oar.noaa.gov/spotlite/archive/spot_snapperfarm.html

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Schrope, Mark Technology Review, April 19, 2001 Aquaculture Cleans Up Its Act Researchers investigate recirculating water from fish farms, and moving them farther offshore. http://www.technologyreview.com

The Rationale For a New Initiative in Marine Aquacuture, NOAA 2002. http://www.nmfs.noaa.gov/trade/AQ/AQWPPrint.pdf

8.3.2F Subtopic: Sensors for Early Warning of Contamination of Fisheries Environments

A threat to the productivity of national fisheries resources due to either intentional large-scale contamination of the marine environment, or incidental non-point source pollution over a period of time, can have serious implications on the food supply. The vast expanse of the fisheries makes the routine monitoring of water quality using the state-of-the-art chemo-biological sensors expensive and impractical. A compelling need clearly exists for an inexpensive, small, non-power consuming, sensor, that will function as a sensitive early-warning device that monitors the health of the ecosystem. The envisioned device must maintain calibration over long periods of marine exposure and ideally allow visual assessment of data (without the need for any specialized equipment).

The kinetics of development, the composition and the succession in macrofoulant invertebrate colonies are well known to be sensitive to low levels of pollutants in the marine environment. The change in colony parameters readily visible to a trained observer should therefore be indicative of low-level contamination of the fishery. We request a Phase I study that might demonstrate the utility of foulant colonies on a suitable substrate as a widely deployable semi-quantitative sensor of the health of fisheries and oceans in general. Realistic low-level contamination that impacts the food web of the fishery must be observable by this approach. The design of the device may include a means to concentrate the organic toxicant/pollutant species to obtain a magnified response. Ideally, the design may allow the sampling and identification of the responsible chemical species as well.

Boreo, F., 1984. The Ecology of Marine Hydroids and Effects of Environmental Factors, Marine Excology, 5, 93-118

Hatcher, A. M. 1998. Epibenthic Colanization Patterns on Slabs of Stabilized Coal-waste in Poole Bay, Hydrobiologia, 367, 153-162

Moran, P.J. 1993 Larval Settlement of Marine Fouling Organisms in Polluted Water from Port Kembla Harbour, Australia, Marine Pollution Bulletin, 26, 512-514

8.3.3F Subtopic: Development of a Digital Video Plankton Recorder (VPR)

Plankton identification and enumeration are highly specialized, time consuming part of the Northeast Fisheries Science Centers monitoring and research programs. Most large scale plankton monitoring programs utilize depth integrated samplers such as bongo nets (Jossi and Marak,1975) or gulf nets(White and Connolly, 2000). Newly developed ecosystem monitoring models (Werner *et al.*, 1996, Lough *et al.*, 2003) require vertically stratified plankton data. This type of data is currently only available from specialized MOCNESS (Weibe *et al.*, 1985), multinet, or towed V-fin video plankton recorder (Davis *et al.*, 1996) cruises. Because of the expense, the large number of experienced scientists, the amount of specialized equipment, and the time and expertise needed to process each sample, it would be difficult if not impossible to integrate this type of cruise into a long term, large scale plankton monitoring program.

We request proposals to develop and field test a two camera, self contained digital VPR. Two adjustable frame cameras will allow enumeration of larger zooplankton and microplankton simultaneously. Development of a graphical user interface will permit identification and measurement of individual zooplankton images which can then be merged with data from oceanographic sensors. Mounting the system on our 1m MOCNESS system will allow close quantitative and taxonomic comparisons between net sampling and the digital VPR accuracy.

The digital VPR will offer technology easily transferred to other NOAA or commercial projects. With a slight change in mounting brackets the self contained VPR can be deployed on other oceanographic sampling gear such as CTDs, bongos, or a towed V-fin. The computer software can append physical oceanographic sensor data from a variety of sources. The end-user graphical interface could be adapted for numerous sampling requirements. The small amount of lab space required makes it a system that is deployable on small sized research vessels, a foreign vessels, or ships of opportunity. The camera magnifications should be changeable to accommodate different research goals. The self contained system should require no modification of ships terminations, no conducting core wire, nor specialized winches. The system should be set up by technical personnel then run by any available technician with a minimal of training. Once development and sea testing are complete the self contained digital VPR will be a cost effective, accurate, alternative to current net type samplers.

References:

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Jossi, J.W., and R.R. Marak,1983. MARMAP Plankton Survey Manual. U.S.Department Commerce, NOAA Tech. Rep. , NMFS-F/NEC-21, 258 pp.

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Weibe, P.H., A.W. Morton, A.M. Bradley, R.H.Backus, J.E.Craddock, V.Barber, T.J.Cowles, and G.R.Flierl, 1985. New development in the MOCNESS, an apparatus for sampling zooplankton and micronekton. Marine Biology, 87, 313-323.

Werner F.E., R.I. Perry, R.G. Lough, and C.E. Naime, 1996. Trophodynamic and advective influences on Georges Bank larval cod and haddock. Deep-Sea Research II, 43, 1793-1822.

White, J., P.Connolly, 2000. Retrospective study analysis, Report of the fisheries application meeting, The Marine Institute, Dublin, Ireland, 86 pp.

8.3.4F Subtopic: Bottom Water Temperature Probe with Real-Time Readout

Generations of New England lobstermen have noticed the abundance and activity of their prey respond to oceanographic events. Episodes of up welling and down welling, for example, along the coast of Maine apparently affect the distribution and migration of animals. The bottom water temperatures evidently change the movement and feeding cycles. With now over six million lobster traps in the Gulf of Maine alone, there are thousands of curious lobstermen.

We request development of a temperature probe that will retain bottom water values so that, as it is hauled on deck, lobstermen (or any type of fishermen) can determine the real-time bottom water record. Since there are several probes on the market that internally record temperature, the degree of engineering necessary to add a real-time display is minor. The probe can be developed to display temperatures recorded on the previous hour, for example, so that the reading is not biased by the upper water column or air temperatures as it is hauled up on deck.

The development of this probe would be a significant addition to a program already underway for the last three years called "Environmental Monitors on Lobster Traps" (see http://www.emolt.org). Over one hundred individuals have attached temperature probes to their traps and have the data downloaded 1-2 times per year. Many of these participants have expressed interest in getting a more real time readout so that they do not have to wait several months lag before seeing the bottom water temperatures at any particular day.

The infrastructure that has made the eMOLT project work is the set of lobster associations. There are several organized groups throughout New England with monthly meetings and newsletters by which notices can be distributed to thousands of individuals. In addition to these regional groups there are annual forums/trade shows with hundreds of lobstermen attending. The combination of these associations and forums allows an easy communication between fishermen, scientist, and commercial enterprise.

8.3.5F Subtopic: Rugged Electrodes for Mapping Sediment Habitat Chemistry

The effects of eutrophication-generated hypoxia and anoxia at the sediment-water interface in significantly reducing fisheries productivity are well documented on a site specific basis (e.g., Bejda *et al.* 1992). But, the horizontal distribution and patchiness of habitat variables are poorly known and need to be mapped in order to move our understanding of Essential Fish Habitat to the next level and place Fisheries Management within an Ecosystem approach.

Existing electrodes (Cai and Reimers 1993; Luther *et al.* 1998) have been used to produce high resolution, detailed analysis of the vertical chemical habitat structure (<0.5 mm resolution) about the sediment-water interface (e.g., Luther *et al.* 1999). The small

size of the electrodes (10 cm long glass tube, less than 1 mm diameter) produce minimal disturbance to the sediment chemistry profiles. Thus, these electrodes are very successful at achieving the purpose for which they were designed but their extreme delicacy renders them unusable for large scale, routine mapping of these same variables.

A number of programs in NOAA Fisheries are currently moving into phases where new forms of chemical sensors are a critical need. These projects employ (or will employ) more frequent visitations of the sediment-water interface to understand the distribution of organisms and map their habitats.

Traditionally, towed benthic vehicles have been equipped with temperature, depth and, perhaps, salinity and galvanic electrodes for oxygen as well as cameras and multiple closing nets to observe fish The realization that the micro-scale of habitats is used by fish suggests that new equipment is required. Specifically, continuous (or semi-continuous), *in situ*, detailed chemical measurements of the sediment-water interface are needed. This requires the transfer of Luther *et al.*s (1999) approach of detailed vertical observations at a site to a rugged version of the electrode that can be towed through the surface sediment or dropped in on a "SEABOSS" (Seabed Observation and Sampling System). The goal is to trade traditional vertical detail for the ability to obtain data over a broader area at wider vertical intervals (~5-10 mm). The new electrode configuration is envisaged as working in all sediment types from mud to gravel and as being able to withstand encounters with rock. It is expected to have significant commercial potential as a new approach to marine and freshwater habitat characterization.

References:

Bejda, Phelan, and Studholme. 1992. The effect of dissolved oxygen on the growth of young-of-the-year winter flounder, Pseudopleuronectes americanus. Envir. Biol. Fish 34:321-327.

Cai, W. -J., and C. E. Reimers. 1993. The development of pH and pCO2 microelectrodes for studying the carbonate chemistry of pore waters near the sediment–water interface. Limnol. Oceanogr. 38: 1776–1778.

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Luther, G.W.III, Reimers, C.E., Nuzzio, D.B., and Lovalvo, D., 1999. Deployment of voltammetric, potentiometric and amperometric microelectrodes from a ROV to determine dissolved O2, Mn, Fe, S^{-2} and pH in porewaters. Environ. Sci. and Technol., 33, 4352-4356.

8.3.6F Subtopic: Submersible *In Situ*, Sediment Grainsize Device

A number of programs in NOAA Fisheries are currently moving into phases where continuous moving measurement fish habitats are being made. Observations from towed sleds permit mapping of habitat and resource distribution in a way never before accomplished. But, measurements of sediment characteristics have not kept pace with temperature, salinity, chemical, and even fish observations (from cameras and multiple closing nets).

Current approaches to marine grainsize measurement rely on processing discrete grab samples in shore-based laboratory analyses using lasers and computers. While this relatively rapid instrumental method has superseded the tedious gravimetric methods based on wet settling rate, an order of magnitude increase in sampling frequency is needed. Measurement systems need to be deployed directly in the habitat with other instruments to make continuous demersal observations.

Particle size devices that are similar to the needed system have been used both towed and fixed in river systems to estimate sediment transport (e.g., Melis *et al*. 2002). We suggest one approach might be to miniaturize the system used in rivers (Gray *et al*. 2002; Melis *et al*. 2002) with the development of a submersible chip-laser based grainsize device that can be mounted on towed sleds and even on SeaBoss (a "dropped" sampling system). The sediment will likely have to be systematically suspended before analysis. This will likely be easier in the towed format than the more static "dropped configuration.

The proposed device would generate horizontal grainsize distributions which would permit mapping of Essential Fish Habitat at a new level, which is necessary to place Fisheries Management within an Ecosystem approach. It seems likely that a successful device would have a wide market as a new approach to marine and freshwater habitat characterization.

References:

Gray, J. R., G.D. Glysson and D.S. Mueller. 2002. Comparability and Accuracy of Fluvial-sediment Data – A View from the U.S. Geological Survey. Turbidity and other sediment surrogates workshop, Glysson, G.D., and Gray, J.R., eds: http://hydroacoustics.usgs.gov/reports/jrgpaper.pdf.

Melis, T.S., Topping, D.J., and Rubin, D.M., 2002, Testing laser-based sensors for continuous, in-situ monitoring of suspended sediment in the Colorado River, Grand Canyon, Arizona, *in*, Turbidity and other sediment surrogates workshop, Glysson, G.D., and Gray, J.R., eds: http://water.usgs.gov/osw/techniques/TSS/Meliseta.pdf>(June 12, 2002).

8.3.7F Subtopic: Bluefish-Specific Monoconal Antibodies

There are no antibodies currently available for the two critical biomarker proteins that have been purified from bluefish. Both proteins (CYP1A and Vtg) are commonly used as indicators of exposure of fish to anthropogenic contaminants in the habitat. Researchers attempting to answer the question of exposure are forced to use antibodies produced from other fish species. It is presently unclear whether any of the different antibodies currently available are similar enough that they will cross-react with the appropriate bluefish protein. The fact that *Pomatomus saltatrix* is the sole member of the Family: *Pomatomidae*, means there are no closely related species that can be substituted. This makes it difficult to determine which available host-species would make the most appropriate surrogate. We recently succeeded in using a striped bass monoclonal antibody for detecting artificially induced vitellogenin expression in young-of-the-year bluefish, however the sensitivity of detection using a non-bluefish antibody is not known for the purpose of quantification.

Companies like Biosense and Caymen Chemicals currently sell antibodies for both of these proteins produced from several different host-species, and they are regularly

adding new species when they become available. Bluefish is a popular recreational and commercial species which has experienced a substantial decline in landings in recent years, creating concerns about stock sustainability. The availability of specific antibodies for CYP1A and Vtg would provide an important monitoring tool to determine the extent and magnitude of the populations exposure to anthropogenic contaminants, a critical factor in understanding the health of the bluefish population.

8.3.8F Subtopic: Modifying Existing Technology to Better Assure the Public Health Safety of the Gulf of Mexico Molluscan Shellfish

The continued vitality and market access of Gulf of Mexico (GOM) oysters is at extreme risk due to increasing public health concerns which result from harvesting the resources during the summer months. Gulf oysters harvested during the summer months contain high numbers of a marine pathogen (*Vibrio vulnificus*) that can cause severe illness, and even death, when consumed by individuals who are immunocompromised. The issue is of such concern that the U.S. Food and Drug Administration (FDA) is considering to not allow the interstate shipment of Gulf oysters harvested during the summer months. In order to prevent this drastic action, FDA has agreed to the Interstate Shellfish Sanitation Conference's (ISSC - the federal/state/industry consortium that develops national molluscan shellfish regulatory policy) National *Vibrio vulnificus* Control Plan that has, as a performance standard, the reduction of the rate of vibrios illness by 40% in 2004-2006 average and 60% in 2007-2008 from the average illness rate for the year 1995-1999 (0.036 per million). There is a further requirement to ISSC's Control Plan that Post Harvest Treatment (PHT) capacity by processing plants in the Gulf of Mexico be increased by 25% for all oysters for the half-shell market by December 31, 2004. To date, only six percent of Gulf oysters receive PHTs.

Commercial PHTs (e.g., High Hydrostatic Pressure Technology) are currently used. However, the cost of this technology is exorbitant (up to $1.5KK per facility) and has limited production volumes. The price structure of the available technology is far outside the cost structure of many of the oyster industry members which are small family businesses that are unable to secure necessary venture capital financing to convert to PHT processing. By conducting the necessary Phase I and II research and re-engineering the current High Hydrostatic Pressure Technology, through a NOAA Small Business Innovation Research Program (SBIR) grant, it is envisioned that PHT processing technology could be made available at a much lower cost ($500 - 750K per facility) which would meet the needs of most small Gulf oyster processors. Aside from the bactericidal properties the High Hydrostatic Pressure Technology, severs the aductor muscle from the oyster, thus providing a great labor-saving benefit of the oyster shucking processing. It is believed that if the High Hydrostatic Pressure Technology costs can be reduced to $550 - 750K per facility, those costs could be quickly recovered by the majority of the small oyster processing facilities with increased product market access and reduced labor costs by increased shucking efficiency.

Not waiting for the full implementation of the National ISSC *Vibrio* Control Plan, the State of California instituted new emergency regulations requiring that only PHT oysters from the Gulf of Mexico be sold in the State. This regulation restricts the sale of raw oysters harvested from the Gulf of Mexico from April 1 to October 31, unless the oysters are treated with a scientifically validated PHT process to reduce *V. vulnificus* to non-detectable levels. Other states are expected to follow California's lead. Therefore, time is of the essence to engage in NOAA's SBIR Phase I detail design and determining the adaptability existing pumps and controls. During Phase II a commercial unit will be built

and tested. This endeavor will make the technology available and more economically applicable to the Gulf of Mexico oyster industry.

References:

ISSC. 2000. RTI. Economic Impact of Requiring Post Harvest Treatment of Oysters. pp. ES1-ES7. March. http://www.issc.org/On-Line_docs/onlinedocs.htm

ISSC. 2001. 2001 Summary of Actions with FDA Comments: 2001 Summary of Actions Taskforce I Issue Number 00-101/201/301 (hereafter referred to as Issue 00-201). *Vibrio vulnificus* Risk Management Plan. http://www.issc.org/On-Line_docs/onlinedocs.htm

Memo: "What's Hot": California Emerging Regulations. http://www.issc.org/On-Line_docs/onlinedocs.htm

8.4 TOPIC: OCEAN SCIENCE

8.4.1SG Subtopic: Aquaculture: Developing and Improving Species Culture

Proposals are requested for research which offers to make significant, industry-wide improvements in finfish, shellfish, and ornamental fish culture systems for both small scale and large scale applications. Priority will be given to research which finds innovative approaches that will solve major industry bottlenecks in an economically and environmentally compatible manner. Research aimed at new species for culture and research to adapt techniques being used successfully in other countries are appropriate.

8.4.2SG Subtopic: Aquaculture: Water Reuse and Effluent Treatment Systems

Proposals are requested for developing integrated aquaculture systems with minimum impact on the environment. These include development of innovative water reuse systems for ponds and raceways and other novel systems for treating effluent. Special priority will be given to prototype, modular water reuse systems suitable for producing a variety of species anywhere in the United States.

8.4.3F Subtopic: Aquaculture: Recirculating Seawater Systems Technologies

Development of recirculating systems for the culture of marine organisms is on the increase in the U.S., as they are environmentally friendly systems. Systems are available for the culture of juveniles and adults, but much less is known about the culture of the early life stages, particularly bivalves, using such systems. Development of recirculating systems for early life stages would reduce space requirements for rearing large numbers of organisms, reduce labor costs for food production, and increase rearing capacity. Such systems would advance significantly the culture and promotion of commercially and recreationally important marine species for both private and public aquaculture and for potential stock enhancement uses.

8.4.4SG Subtopic: Aquaculture of Marine Organisms for Marine Natural Products

Research in the past two decades has found that there are many marine organisms which produce novel natural products of use in treating human diseases. To utilize these products commercially and in clinical trial, however, they need either to be chemically synthesized, produced using biotechnology, or produced through aquaculture of the organism. Research is needed to find economically cost-effective and biologically viable ways to culture marine organisms specifically for their production of novel natural products.

8.4.5SG Subtopic: Open-Ocean Aquaculture Systems

Both engineering and biological technology needs to be explored for the development of open-ocean or offshore culture systems. Large scale, offshore, submersible and floating systems need to be developed for Atlantic, Gulf of Mexico and Pacific conditions. Automation of feeding and harvesting functions as well as telemetry and remote control systems will be considered in this competition. The biological technology would include hatchery, nursery and transport systems for candidate species for open ocean-aquaculture. Field tests of candidate species are encouraged.

8.4.6SG Subtopic: Disease Diagnostics and Controls

Given the severe problems with aquaculture disease diagnostics and controls, we seek proposals in those areas aimed at reducing negative impacts on the US aquaculture industry.

8.4.7N Subtopic: Development of Multi-Hazard Contingency Plans and Tools for National Marine Sanctuaries

This subtopic calls for the development of a web-based contingency plan and set of tools for national marine sanctuary spill planning and management. NOAA requires such a system to bring together in one readily accessible resource, the knowledge and expertise necessary for NOAA to address two critical components of it's management mission: the stewardship of Sanctuary resources and the ability to provide effective and timely response information about NOAA trust resources. These new sanctuary specific spill planning and management tools are needed to meet rapidly changing resource protection priorities in light of national security issues, and resource protection needs within National Marine Sanctuary (NMS) sites.

The subtopic calls for an iterative web-based system providing one source for all relevant resource and maritime use information within the NMS System as well a comprehensive database of underwater hazards within the US coastal zone. It should include GIS maps, environmental sensitivity indexes, resources at risk information, coastal observations systems such as PORTS, TABS and National Data Buoy Center buoy systems, aerial photos, oceanography data, cultural resources, Minerals Management System information, biological baseline data, sonar data, digital charts, etc.

This project should result in the development of All/Multi-Hazard Contingency Plan/Tool for four NMS sites (Florida Keys, Stellwagen Bank, Gulf of the Farallones, and Flower Garden Banks), and also, an All/Multi-Hazard Contingency Plan/Tool that will serve NOAA and its partner management agencies to facilitate decision-making abilities within the coastal zone during non-response events. This includes the USCG Office of Response and the Navy SUPSALV.

This comprehensive contingency plan computer application has the potential to be used to protect coastal resources for state, local and private interests. The one-source system can be utilized by other government agencies, non-profit groups such as land trusts or the private entities to efficiently manage HAZMAT spill and/or natural disaster response and restoration in coastal areas.

8.4.8N Subtopic: Development of Models for Predicting the Physical, Chemical, and Biological Response of Great Lakes, Estuaries, and Bays to changes in natural and human drivers

As a result of increased availability of data, better understanding of estuarine and bay biogeochemical and physical dynamics, availability of powerful graphical software packages, and high speed PCs and workstations, reliable predictions of Great Lakes, estuarine, and bay responses to changes in natural and human drivers are now becoming feasible. This initiative seeks to develop models capable of predicting Great Lakes, estuarine, and bay ecological responses to combined projected changes in nutrient loads and climate. This initiative seeks a general modeling approach that can be used as a screening tool to classify Great Lakes, estuarine, and bay ecosystems with

respect to their sensitivity to these changes. The models should explicitly address responses of water quality (e.g., chlorophyll, dissolved oxygen, water clarity), and ecosystem properties (e.g., sea grass coverage, secondary production) to changes in interannual-to-decadal changes in nutrient loads, watershed precipitation, temperature, water-column stability, and flushing.

8.5 TOPIC: CARTOGRAPHY, PHOTOGRAMMETRY, HYDOGRAPHY, AND GEODESY

8.5.1N Subtopic: Cartographic Data and Geographic Information Systems (GIS)

Innovations with commercial potential are sought incorporating new and emerging technologies related to digital cartographic and GIS systems to support National Ocean Service (NOS) requirements. The NOS makes its products, data, and metadata available to agencies, academia, and the public through electronic access via computer networks. Needed research critical to the NOS mission includes:

a) New methods for generation, update, and transfer of geo-data products and data files from spatial data bases, including raster images, to meet emerging requirements of Electronic Chart Display and Information System (ECDIS) and similar shipboard electronic navigation systems using raster displays.

b) User-transparent approaches to geo-data and geo-processing interoperability across networks (e.g., the Internet), for software interoperability: automatically invoked platform independent processing functions; and data interoperability: user-transparent autonomous standard file format conversions.

c) Innovations for easily locating, accessing, searching, transferring, reformatting, and portraying geo-data and GIS graphic products across networks. These could involve knowledge processing via expert systems and/or neural nets, hyper-links (e.g., Netscape-like), geospatial search engines, or improved conventional techniques.

d) New methods for enhancing/compressing raster images of nautical chart features, including text and feature symbology. These can range from conventional image processing and optical character recognition algorithms to the use of expert systems, fuzzy logic, neural nets, and specialized pattern recognition/matching algorithms.

e) Improved methods for error-free raster-to-vector and vector-to-raster conversion/compression for digital raster images, including semi-automated GIS data attribution and metadata generation directly from the vectorized raster data files.

f) Heads-up raster and vector navigation and nautical charting data shown in two and three dimensional displays for mariners. Such practical information could be shown on (semi-)transparent, portable, heads-up displays superimposed in novel ways on the actual environment to help mariners navigate, especially in conditions of limited visibility.

g) A comprehensive method for remote real-time monitoring of navigation channel depths to within 1 foot and widths to within 10 feet throughout the entire channel length (1 mile to 100 miles). The method must be comparable in cost to the periodic sonar surveys currently in use. A “survey” by this method should require 24 hours or less, if possible.

8.5.2N Subtopic: Hydrographic Survey Technology

Innovations with commercial potential are sought incorporating new and emerging technologies related to Hydrographic applications supporting National Ocean Service (NOS) requirements. The NOS makes its products, data, and metadata available to agencies, academia, and the public through electronic access via computer networks. Needed research critical to the NOS mission includes innovation in use of Kinematic and

Real Time Kinematic GPS (KGPS and RTK) positioning information, innovative methods for determining positions of sensing systems within ships and positions of subsurface platforms:

a) New methods for benchmark leveling using KGPS – These methods include automated techniques for determining positions and heights of NOS benchmarks.

b) New techniques for determining vessel settlement, squat and centroid using KGPS / RTK – Currently, manual sightings of vessels during test runs are used for most settlement and squat calculations. A computer program is currently available to do these calculations from Global Positioning Systems and attitude data collected during test runs. This program is very complex and time consuming, and is only available for post processing. A computer program which could be used in the field to determine settlement and squat would be a valuable tool. Ideally, this tool would be extensible to provide real-time vessel centroid calculations applicable to the marine architecture of the vessel from heave-roll-pitch-heading measurements.

c) New methods for using KGPS/RTK technology for multi beam acquisition from Autonomous Undersea Vehicles (AUV) – Such a system would use buoyed KGPS base stations to compute and broadcast real-time corrections for positioning underwater vehicles to hydrographic accuracies.

d) New techniques for using commercial wireless equipment to determine positions of measurement transducers inside ships to accuracies of 1 cm. There has been some positioning work done using signal strength from multiple base stations, but none involving a modulated or pseudo-random code carrier positioning system based on this inexpensive technology. The use of alternate frequencies, especially those in the VHF range, would improve reception and reduce multipath effects inside ships. NOAA has several assigned frequencies that would be suitable for this work. Commercial application would ideally use common spectrum without impacting such current uses as WiFi network data transfer.

e) Development of a Remotely Operated Vehicle (ROV) depth measurement system – Such a system would incorporate multiple depth determination methods, such as absolute pressure sensors, relative pressure sensors, analysis of conductivity, temperature, and depth measurements, Acoustic Doppler Current Profilers (ADCP) measurements to the surface, or other means. A repeatable measurement precision of 1 cm and 95% accuracy of less than 5 cm is expected by Phase 2. The device must physically measure less than 20 cm x 10 cm x 10 cm, be slightly buoyant, and have minimal measurement drift. A "self-calibrated" instrument would be optimal.

f) Development of analytically based Conductivity-Temperature-Depth measuring system (CTD) cast frequency techniques – CTD Casts are acquired periodically during hydrographic surveys. They are required in order to accurately determine sound velocity in water and to do sound ray tracing. The spatial and temporal frequency with which CTD casts are acquired is a trial and error proposition. Developing an analytic procedure for determining this frequency would save time and money during surveying. The largest problem is in near-shore estuarine environments, such as bays, inlets, and river deltas, but there are also problems with open coasts with significant non-point source runoff and rapid surface warming from sunshine.

g) Develop software to automate side scan sonar contact recognition – The software would be used for sonar imagery analysis, and act as a prompting system to present potential contacts for final human interpretation. A high probability (95%) of

detection is desired with a corresponding low false alarm rate. Ideally, the software would allow detection of objects one meter cubed without prior assumptions about object structure, and operate with high reliability in diverse acoustic backgrounds. The ideal system should provide the capability to measure length, width and height of any detected contact analogously to measurements now performed manually. The goal of this software is to reduce operator intervention and increase productivity in contact recognition.

9.0 SUBMISSION FORMS

9.1 NOAA/SBIR COVER PAGE

PROGRAM: NOAA/SBIR - SMALL BUSINESS INNOVATION RESEARCH	This firm and/or Principal Investigator ☐ has ☐ has not submitted proposals for essentially equivalent work under other federal program solicitations, or ☐ has ☐ has not received other federal awards for essentially equivalent work.
SOLICITATION NO.: DOC 2004-1	CLOSING DATE: January 14, 2004
NAME OF SUBMITTING FIRM	TAXPAYER ID NO.
ADDRESS OF FIRM (INCLUDING ZIP CODE + 4)	
TITLE OF PROPOSED PROJECT	
REQUESTED AMOUNT: $	PROPOSED DURATION: 6 MONTHS
SOLICITATION SUBTOPIC NO.	SOLICITATION SUBTOPIC TITLE

THE ABOVE ORGANIZATION CERTIFIES THAT: (Check appropriate box by hitting space bar)	YES	NO
1. It is a small business firm as defined on page 3.		
2. The primary employment of the principal investigator will be with the firm at the time of award and during the conduct of the research.		
3. A minimum of two-thirds of the research will be performed by this firm in Phase 1.		
4. It qualifies as a minority and disadvantaged small business as defined on page3.		
5. It qualifies as a woman-owned small business as defined on page 4.		
6. It will permit the government to disclose the title and technical abstract page, plus the name, address and telephone number of the corporate official if the proposal does not result in an award to parties that may be interested in contacting it for further information or possible investment.		

PRINCIPAL INVESTIGATOR/ PROJECT DIRECTOR	CORPORATE OFFICIAL (BUSINESS)	OTHER INFORMATION
NAME	NAME	YEAR FIRM FOUNDED
SIGNATURE DATE:	SIGNATURE DATE:	NUMBER OF EMPLOYEES Avg. Previous 12 mos. _____ Currently _____
TITLE	TITLE	HAS THIS PROPOSAL BEEN SUBMITTED TO ANOTHER AGENCY? Yes_____No_____
TELEPHONE NO. + AREA CODE	TELEPHONE NO. + AREA CODE	IF YES, WHAT AGENCY?
E-MAIL:	E-MAIL:	FAX #:

PROPRIETARY NOTICE

For any purpose other than to evaluate the proposal, this data shall not be disclosed outside of the Government and shall not be duplicated, used or disclosed in whole or in part, provided that if a funding agreement is awarded to this proposer as a result of or in connection with this submission of this data, the Government shall have the right to duplicate, use, or disclose the data to the extent provided in the funding agreement. This restriction does not limit the Government's right to use information contained in the data source without restriction. The data in this proposal subject to this restriction is contained on separate proprietary page(s).

9.2 NOAA/SBIR PROJECT SUMMARY FORM

NAME OF FIRM	AMOUNT REQUESTED
ADDRESS	PHONE # FAX # E-MAIL:
PRINCIPAL INVESTIGATOR (NAME AND TITLE)	
TITLE OF PROJECT	
SOLICITATION SUBTOPIC NUMBER	SOLICITATION SUBTOPIC TITLE
TECHNICAL ABSTRACT (LIMIT 150 WORDS)	
KEY WORDS	
POTENTIAL COMMERCIAL APPLICATIONS	

9.3 NOAA/SBIR PROPOSAL SUMMARY BUDGET

FIRM:	PROPOSAL NUMBER: (Leave Blank)
PRINCIPAL INVESTIGATOR:	
	PRICE
DIRECT LABOR:	$
OVERHEAD RATE:	$
OTHER DIRECT COSTS:	$
MATERIALS:	$
GENERAL AND ADMINISTRATIVE (G&A):	$
PROFIT:	$
TOTAL PRICE PROPOSED:	$ 0.00
TYPED NAME AND TITLE:	SIGNATURE:_____
THIS PROPOSAL IS SUBMITTED IN RESPONSE TO NOAA SBIR PROGRAM SOLICITATION 2004-1 AND REFLECTS OUR BEST ESTIMATES AS OF THIS DATE. **DATE SUBMITTED:_____**	

9.4 NOAA/SBIR BUDGET INSTRUCTIONS

The offeror is to submit a cost estimate with detailed information for each element, consistent with the offeror's cost accounting system. This does not eliminate the need to fully document and justify the amounts requested in each category. Such documentation should be contained, as appropriate, on a budget explanation page immediately preceding the budget in the proposal.

1. Principal Investigator (PI).

The PI must be with the small business concern at the time of contract award and during the period of performance of the research effort. Additionally, more than half of the PI's time must be spent with the small business firm during the contract performance.

2. Direct Labor.

All personnel (including PI) must be listed individually, with the projected number of hours and hourly wage.

3. Overhead Rate.

Specify current rate and base. Use current rate already negotiated with a Federal agency, if available. If no rate has been negotiated, a reasonable overhead rate (10-15% is average) may be requested, which will be subject to approval by NOAA. Overhead includes fixed costs not directly related to the research effort, e.g. rent, heat, light, facilities, telephones, maintenance, insurance, etc.

4. Other Direct Costs.

List all other direct costs which are not described above (i.e. consultants, subcontractor, travel, and equipment purchases). Each of the above needs a detailed explanation and elaboration of its relation to the project. (Up to $4,000 may be allocated for technical and commercial assistance.)

5. Materials.

The materials and supplies required for the project must be identified. There is also a need to specify type, quantity, unit cost, and total estimated cost of these materials and supplies.

6. General & Administration (G&A).

Specify current rate and base. Use current rate already negotiated with a Federal agency, if available. If no rate has been negotiated, a reasonable G&A rate may be requested, subject to approval by NOAA. G& A includes costs associated with managing and running the small business, e.g. computers, copier, marketing, charitable contributions, loans, gifts, entertainment, dues, etc.

7. Profit.

The small business may request a reasonable profit (about 7 percent of costs is the average proposed).

10.0 NOAA/SBIR CHECKLIST

Please review this checklist carefully to assure that your proposal meets the NOAA requirements. Failure to meet these requirements may result in your proposal being returned without consideration. **Six copies of the proposal must be received by Noon EST January 14, 2004.**

_____ 1. The proposal is **25 PAGES OR LESS** in length.

_____ 2. The proposal is limited to only **ONE** of the subtopics in Section 8.

_____ 3. The proposal budget is for **$75,000 or LESS** (or $50,000 or less for those subtopics designated as "SG"). No more than one-third of the budget goes to consultants and/or subcontractors.

_____ 4. The abstract contains **no proprietary information** and does **not exceed** space provided on the Project Summary.

_____ 5. The proposal contains only pages of 21.6cm X 27.9cm size (8 ½" X 11").

_____ 6. The proposal contains **an easy-to-read font (fixed pitch of 12 or fewer characters per inch or proportional font of point size 10 or larger) with no more than 6 lines per inch,** except as a legend on reduced drawings, but not tables.

_____ 7. The **COVER PAGE** has been completed and is **PAGE 1** of the proposal.

_____ 8. The **PROJECT SUMMARY** has been completed and is **PAGE 2** of the proposal.

_____ 9. The **TECHNICAL CONTENT** of the proposal begins on **PAGE 3** and includes the items identified in **SECTION 3.3.3** of the solicitation.

_____ 10. The **SBIR PROPOSAL SUMMARY BUDGET** has been completed and is the **LAST PAGE** of the proposal.

_____ 11. The P.I. is employed by the company.

NOTE: Proposers are cautioned to be careful of unforeseen delays that can cause late arrival of proposals, with the result that they may be returned without evaluation.

11.0 SBIR NATIONAL CONFERENCES

FEDERAL R&D OPPORTUNITIES
FOR
TECHNOLOGY INTENSIVE FIRMS

Sponsored by:
Department of Defense/National Science Foundation
In Cooperation with
All Federal SBIR Departments and Agencies

Marketing Opportunities for R&D and Technology Projects with Federal Agencies and Major Corporations.

Techniques and Strategies for Commercializing R&D through Venture Capital, Joint Ventures, Partnering, Subcontracts, Licensing, and International Markets.

Management seminars in Marketing and Business Planning.

Working with Academia and the States.

National Critical Technologies

Agency and company exhibits and/or One-on-One tables will be open for networking opportunities for all attendees!

CLEVELAND, OH	OCTOBER 27-30, 2003
ATLANTA, GA	APRIL 26-29, 2004
WASHINGTON, DC	2004

For further information:

SBIR Homepage: www.sbirworld.com